susceptible one. Tests of resistance were made in the greenhouse, using the same local isolate. The $F_1$ plants were susceptible. In the $F_2$, a 3:1 segregation ratio was observed (Table 1), indicating that resistance was controlled by a single recessive gene. The data of the two backcrosses substantiated the $F_2$ results.

According to what has been found so far, it seems that there are different resistances to angular leaf spot in beans. Barros et al. (Phytopathology 47:3, 1957) observed in most crosses that resistance appeared to be recessive and controlled by two or three independent factors. In a very few crosses, resistance was dominant. Cardona Alvarez (IV Reunion Latinoamericana de Fitotecnia, p. 235-236, 1958) found that the resistance of the line 0258 was dominant and governed by one gene.

Table 1. Segregation for Angular Leaf Spot Resistance in Generation Derived from the Cross 'Caraota 260' (Resistant) and 'Venezuela 350' (Susceptible).

| Generation | Number of plants | | Expected ratio | P |
|---|---|---|---|---|
| | Resistant | Susceptible | | |
| Caraota 260 | all | --- | | |
| Venezuela 350 | --- | all | | |
| $F_1$ | --- | all | | |
| $F_2$ | 52 | 138 | 1:3 | .50 |
| $F_1$ X Caraota 260 | 30 | 28 | 1:1 | .80 |
| $F_1$ X Venezuela 350 | --- | all | | |

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## SCLEROTIA POPULATIONS OF SCLEROTINIA SCLEROTIORUM IN DIFFERENT CROP ROTATIONS

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Extensive soil sampling was conducted within selected fields in the North Platte Valley during 1974-1975 to monitor sclerotia populations of Sclerotinia (Whetzelinia) sclerotiorum. Soil depths were sampled to 7.5 cm in 1974 and 20 cm in 1975 within a 10 cm wide by 20 cm long trench (7-20 random sites per field). Since our 1974 study (BIC, 1975) demonstrated that sclerotia distributed throughout the 20 cm vertical soil profile of an irrigation furrow could germinate to form apothecia, 1975 samples were taken to a 20 cm depth. All soil samples were aid dried for 2-5 days, weighed and sieved on 1.59 mm mesh screen (dry sieved in 1974 and wet sieved in 1975).

Sclerotia recovered from spring soil samples had been produced the previous fall, and thus most had undergone the conditioning process necessary to break dormancy and allow carpogenic germination. When placed on water agar at 18°C, 71% of the sclerotia germinated to form apothecia within 12-14 days. Sclerotia recovered from fall soil samples included conditioned sclerotia (14%), and newly-formed sclerotia which germinated to form hyphae.

Lower sclerotia populations per kg dry soil were detected in 1975 than in 1974, even in fields that had been planted continuously to beans for up to 8 years and that had annual white mold epidemics. It is not apparent whether this decrease is significant, and it is hoped that future samplings will resolve this. One field had a sclerotia population of only 0.4 per kg dry soil in the spring of 1975, yet incited an average disease incidence of 46% in GN 'Tara'.

Previous studies (BIC, 1973 and 1975) demonstrated that significant levels of sclerotia survive for at least 3 years under fallow conditions, but the effect of crop rotation was not studied. To determine crop rotation effects, the sclerotia population of a field which had a severe white mold epidemic in 1973 was monitored during subsequent cropping. In addition to sclerotia, numbers of apothecia and white mold incidence were estimated during the rotation (Table 1). Numerous apothecia were seen during random observations beneath the beet canopy on August 8, 1974, and frequent flushes of new apothecia continued to appear until the end of September. Very few apothecia were seen during random observations beneath the corn canopy during 1975. No infection due to S. sclerotiorum was found in either the sugar beet or corn crop.

Table 1. Sclerotia populations of Sclerotinia (Whetzelinia) sclerotiorum in a non-host cropping sequence following beans.[a]

| Sampling date | Crop | Sclerotia/kg of soil[b] | Apothecia/$m^2$[c] |
|---|---|---|---|
| Fall, 1973 | Following beans | 5.5 | - |
| Spring, 1974 | Beets | 2.3 | 15-20 |
| Spring, 1975 | Corn | 0.9 | 1 |
| Fall, 1975 | Following corn | 0.7 | 0 |

[a] A severe white mold epidemic occurred in beans in 1973. No apothecial counts made at that time.

[b] 1973 soil sample was 5 cm deep by 30 cm wide by 30 cm long. 1974 soil sample was 7.5 cm deep by 10 cm wide by 20 cm long. 1975 soil samples were 20 cm deep by 10 cm wide by 20 cm long. (kg soil represents 2-5% of the total sampled each date.)

[c] Compare to 7-9 apothecia/$m^2$ commonly observed during an epidemic beneath the canopy of a bean variety such as GN Tara in 1975.

Crop rotation reduced the sclerotia population in this single field situation. Based on comparable situations, the inoculum level of 0.7 sclerotia per kg soil found after 2 years of non-host crops may be sufficient to incite a significant amount of white mold infection in 1976 when the field is planted to beans again. The numerous apothecial

fruiting bodies produced in this sugar beet field indicate that ascospore inoculum may be disseminated in irrigation runoff water reused to irrigate beans, or aerially from areas outside bean fields.

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## BEAN CANOPY STRUCTURE INFLUENCES WHITE MOLD DISEASE DEVELOPMENT

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In 1974 and 1975, the initial appearance of apothecia of Sclerotinia (Whetzelinia) sclerotiorum beneath dry edible bean canopies in western Nebraska was recorded on August 6, approximately 60 days after planting. A previous report (Schwartz & Steadman, BIC, 1975) indicated that bean plant growth habit influences production of apothecia. As a continuation of these studies, apothecia were counted on the surface of randomly selected irrigation furrows (75 cm length by 56 cm width) beneath the canopy of bean cultivars on August 8, 1975. The cultivars were planted in a randomized complete block design with each plot, three rows wide and 3 m in length, replicated five times. Sclerotial sites, the number of sclerotia responsible for the observed apothecia, had to be estimated because sclerotia could not be excavated due to effects of inoculum destruction on other experiments in the plot. Since irrigation frequency has been shown to significantly affect apothecial production (Steadman et al., BIC, 1976), comparisons of canopy effects were made under similar irrigation practices.

Statistical analysis revealed no significant difference (5% level) in apothecia/$m^2$ beneath a vine (GN Nebr. #1) compared to a bush (Charlevoix Dark Red Kidney), 8.57 compared to 2.27, respectively. Likewise, plant canopy type did not affect the average number of apothecia produced by a single sclerotium. There was, however, a significant difference (1% level) between sclerotial sites/$m^2$ beneath the vine and bush canopies, 3.11 and 0.36, respectively.

The structural arrangement of bean canopies was also analyzed and related to white mold development in a separate experimental field in 1975. Preplant soil samples revealed that low levels of sclerotia were relatively uniformly distributed throughout the field, and canopy type did not affect the low numbers of observed apothecia. Field corn was planted around the perimeter to provide favorable microclimate conditions for disease development. Windbreaks have been reported to increase the leaf area of dry bean cultivars (N. J. Rosenberg, 1966, Ag. Meteorology, p. 197-224). In another experimental field without a windbreak, total leaf area of a cultivar such as GN Tara was reduced as much as 40-50% when compared with the corn-bordered plot. Thus, the results of our canopy data can be interpreted within the plot but extrapolation to open field should be done cautiously.

Plant canopy samples were harvested by 10 cm vertical increments and divided into two horizontal components. The canopy directly above the vertical plant axis, termed within row site, was 26 cm by 48 cm.